VOLCANOES AND VOLCANISM

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ARENAL VOLCANO, COSTA RICA

VOLCANO

- AN OPENING IN THE CRUST OF THE EARTH, FROM WHICH MOLTEN ROCK AND GASES CAN ESCAPE TO THE SURFACE.
- A MOUNTAIN THAT IS FORMED FROM REPEATED VOLCANIC ERUPTIONS.

MOLTEN ROCK

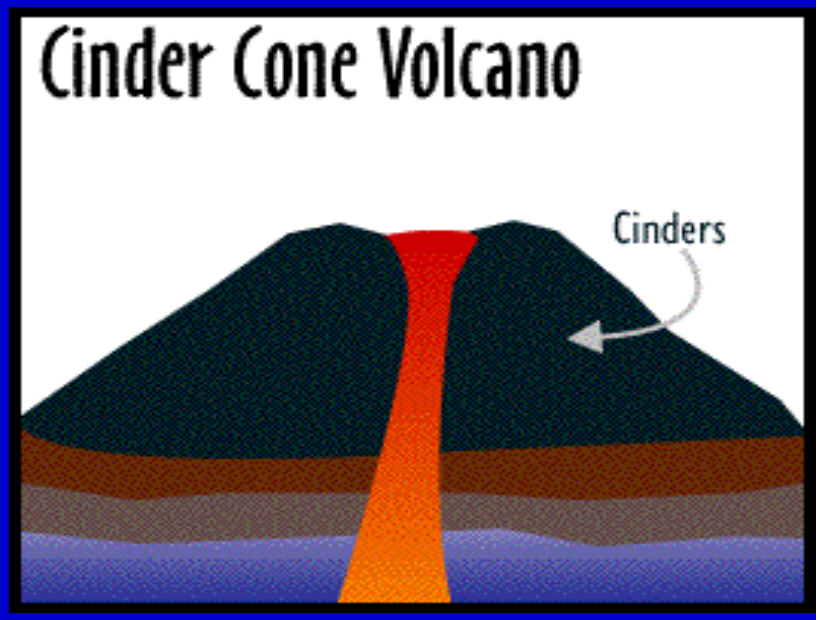
- 1. LAVA IS LIQUID ROCK THAT IS ERUPTED ONTO THE EARTH'S SURFACE.
- 2. MAGMA IS LIQUID ROCK THAT HAS NOT REACHED THE EARTH'S SURFACE.

TYPES OF VOLCANOES

- 1. CINDER CONE
- 2. SHIELD VOLCANO
- 3. COMPOSITE OR STRATOVOLCANO
- 4 LAVA DOME

CINDER CONE

- **Cinder cone:** This is the simplest type of volcano. Cinder cones are built from particles of lava that are ejected from a single vent. The lava is blown into the air, hardens, and breaks into small fragments that fall as cinders around the vent to form a circular or oval cone. Most cinder cones are small, up to a mile across, a thousand feet high, and have a bowl-shaped crater at the summit.



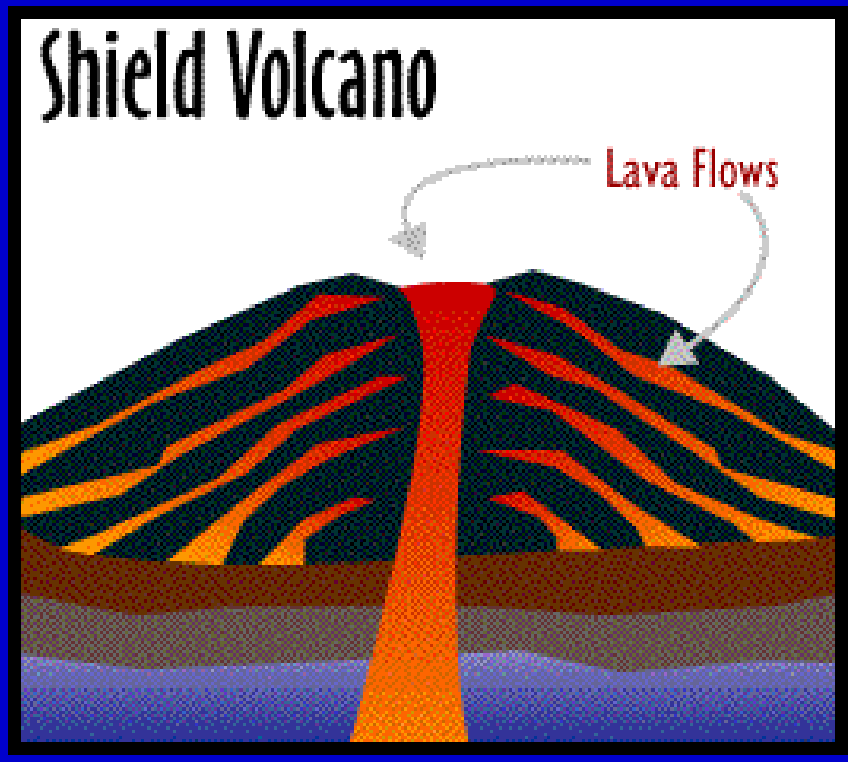
EXAMPLES OF CINDER CONES

Red Cones, Long Valley Caldera, California

Pu u Ka Pele Crater, Mauna Kea Volcano, Hawaii

SHIELD VOLCANO

- **Shield volcano:** A gently sloping volcano in the shape of a flattened dome, built almost exclusively of lava flows. Shield volcanoes are some of the largest volcanoes in the world. Examples of shield volcanoes are Kilauea and Mauna Loa (Hawaii), Fernandina (Galapagos Islands).



EXAMPLES OF SHIELD VOLCANOES

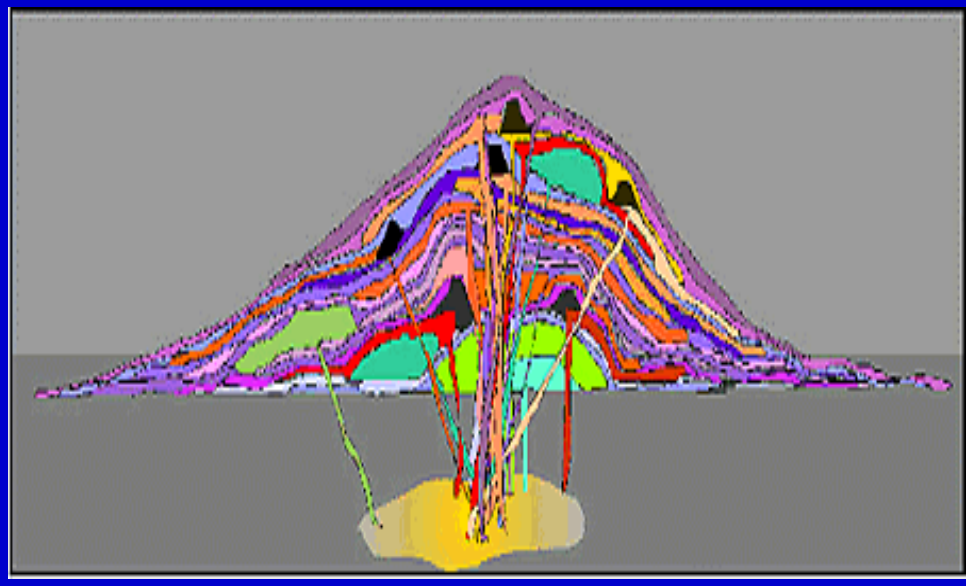
Kilauea, Hawaii

Mauna Kea, Hawaii

COMPOSITE OR STRATOVOLCANOES

Stratovolcanoes comprise the largest percentage (more than half) of the Earth's individual volcanoes. These volcanoes often undergo explosive eruptions. Stratovolcanoes are usually about half lava and half pyroclastic material, and the layering of these products gives them their other common name of composite volcano. Some stratovolcanoes are just a collection of lava domes piled upon each other and are commonly found along subduction-related volcanic arcs. Examples of stratovolcanoes include Mt. St. Helens, Mt. Rainier, Pinatubo, Mt. Fuji, Merapi, Galeras, and Cotopaxi.

- A schematic diagram of a stratovolcano, is presented to illustrate the different layers of materials that comprise them. Purple colors represents ash layers, either the products of fallout from big eruption clouds or the products of pyroclastic flows (ash avalanches). Notice that these ash layers tend to be thin but widespread. Orange represents lava flows. Note that some of them have cinder cones associated with them at the vent. Green represents lava domes. Notice that they do not flow very far.



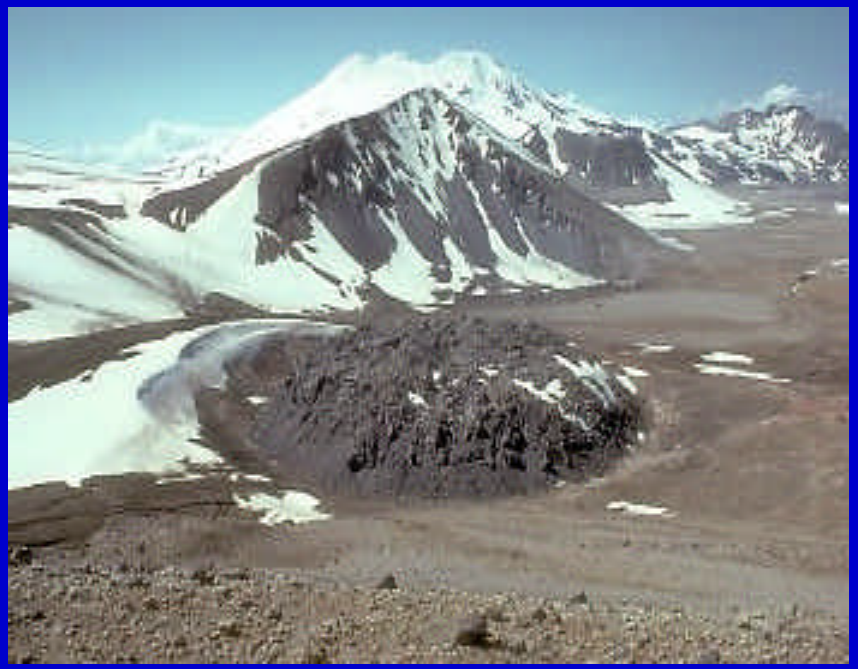
EXAMPLES OF STRATOVOLCANOES

COLIMA VOLCANO, MEXICO

SANTA MARIA VOLCANO, GUATAMALA

LAVA DOMES

- **Lava domes are rounded, steep-sided mounds built by very viscous magma. Such magmas are typically too viscous (resistant to flow) to move far from the vent before cooling and crystallizing. Domes may consist of one or more individual lava flows.**



Novarupta vent, Valley of Ten Thousand Smokes, Katmai National Park and Preserve, Alaska

CATEGORIES OF VOLCANIC ERUPTIONS

Icelandic (least explosive)
Hawaiian
Strombolian
Vulcanian
Pelean
Plinian (most explosive)

ICELANDIC ERUPTION

- ***Icelandic, flood, or fissure eruptions*** are all terms for volcanic eruptions that flood the surface of the Earth with massive amounts of very hot, very thin, runny lava. The lava flows out of the ground through long cracks in the surface called fissures. Some of these fissures can be up to 15 miles long. Icelandic eruptions are the least explosive and some from shield volcanoes. The Columbia Plateau of the western United States is the largest lava plateau in the world and is an example of an Icelandic eruption. It covers almost 100,000 square miles and is nearly a mile thick in places.

HAWAIIAN ERUPTION

- *Hawaiian eruptions* are similar to Icelandic eruptions because both eruption types have many fissures bringing the lava to the surface. Both types of eruption are known for their beautiful fire fountains like the one shown at right. The lava the is very hot, thin, and runny which allows for a fast flowing lava flow.

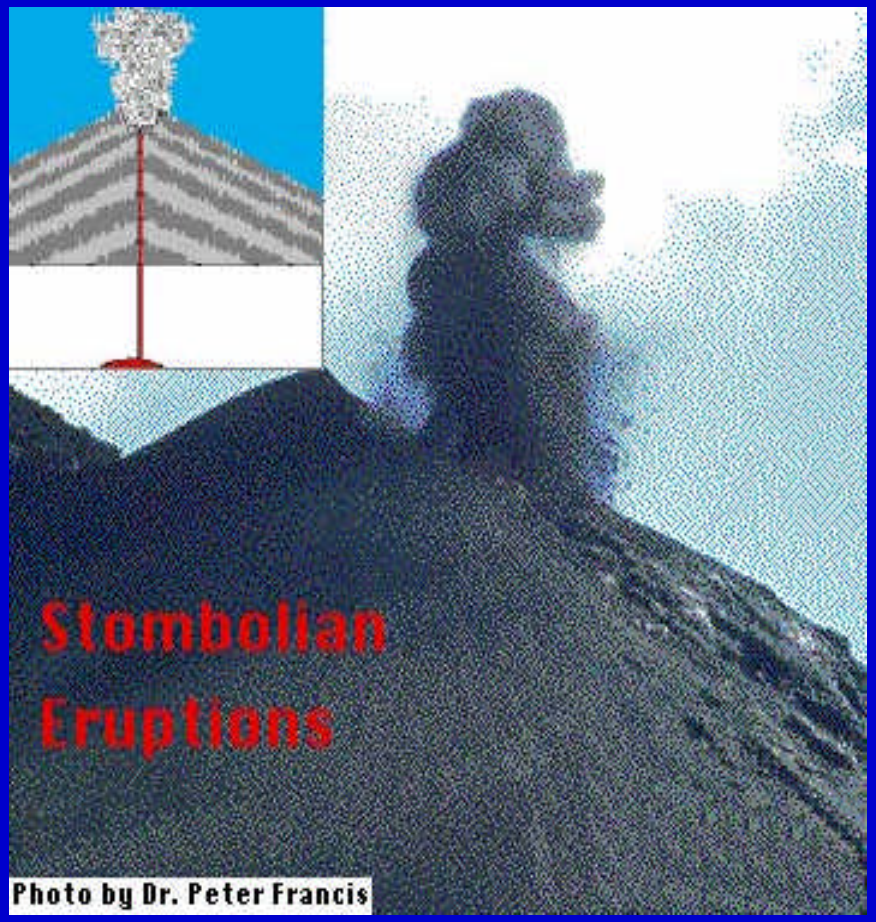
  A distinguishing feature is that most Hawaiian eruptions have the greatest quantity of lava pouring out of the main vent at the volcano's summit, not along side fissures. These summit eruptions build the cone steeper and higher.

STROMBOLIAN ERUPTION

- ***Strombolian eruptions*** **are short - lived explosive eruptions that shoot very thick and pasty lava into the air, along with bursts of steam and gas. These eruptions were named for the volcanic island off the coast of Italy**

- **Strombolian eruptions usually produce little or no lava. Because of this the cones that are produced by this type of eruption are very steep sided and are called cinder cone.**

- **The photo shows a strombolian eruption taking place.**



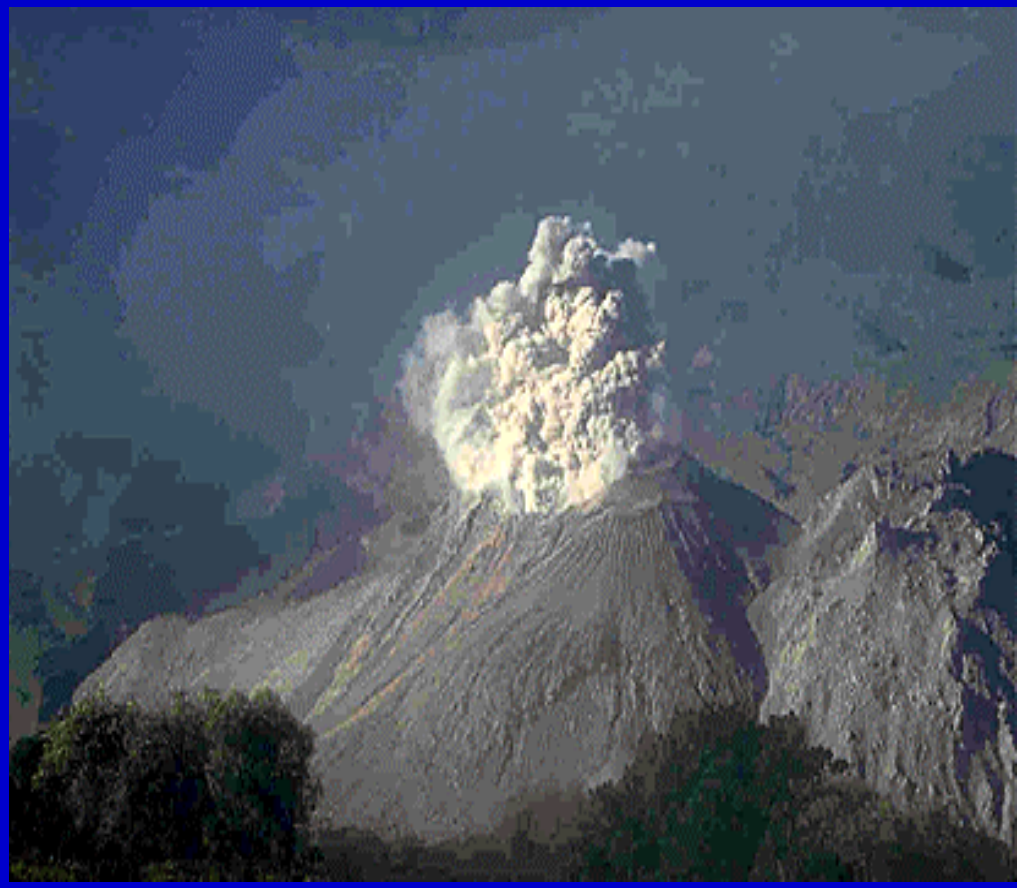
VULCANIAN ERUPTION

- ***Vulcanian eruptions*** **contain high, dark clouds of steam, ash, and gas. The ash plume builds a mushroom-shaped head and a thinner, more tree trunk-like base and can send ash plumes to heights of 2-9 miles. When the volcano stops erupting ash and gas, it then ejects thick, pasty lava. Vulcanian eruptions usually build a steep-sided cone that is more symmetrical than a cinder cone. This more symmetrical cone is called a stratovolcano. Vulcanian eruptions are more violent and explosive than strombolian eruptions. Vulcanian eruptions are named after the island of Vulcano off the coast of Italy. This is the same island that gave us the name volcano.**

Krakatoa Volcano, Sumatra

PELEAN ERUPTION

- ***Pelean eruptions*** **are named for the catastrophic eruption on the island of Martinique in the Caribbean Sea in 1902. Pelean eruptions are very violent . The eruption and the pyroclastic flow or ash avalanche that followed killed 29,000 people almost instantly. "Glowing clouds" of gas and ash flew down the mountain at over 70 miles per hour. The cloud was so full of ash that it was heavier than air and hugged the ground as it approached the coast. The temperatures were probably around 700 degrees F which would annihilate everything in its path.**



Santiaguito, Guatemala

PLINIAN ERUPTIONS

- A *Plinian eruption* is the most explosive of the eruption types. Mt. St. Helens (picture at right) eruption was a Plinian eruption. They are characterized by a very high ash cloud that rises upwards to 50,000 feet (almost 10 miles) high. Very deadly pyroclastic flows are also part of Plinian eruptions.

- Mt. Vesuvius, which erupted in 79 A.D. in Italy, is a classic Plinian eruption. Very hot ash falls killed thousands of people in the city of Pompeii. Ash falls as high as 17 feet buried the city. Plinian eruptions were named for Pliny the Elder of Rome who died in one of the many eruptions of Vesuvius.

Mt. St. Helens, Washington

VOLCANIC EXPLOSIVITY INDEX OR VEI

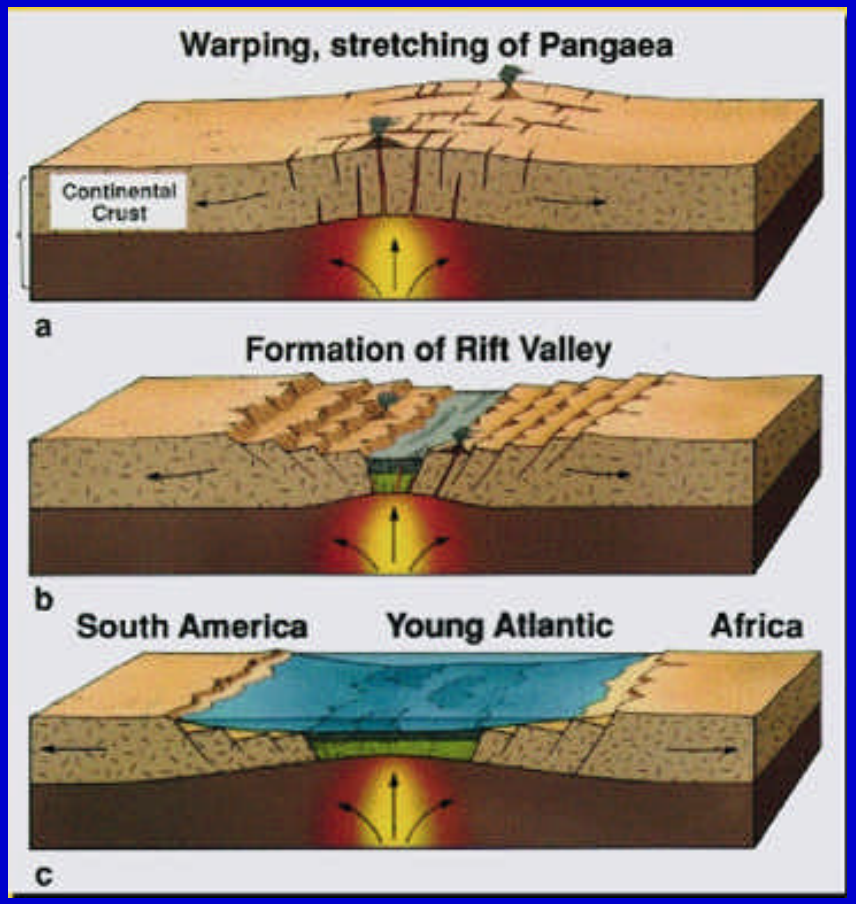
VEI	Description	Plume height	Classification	Example
0	nonexplosive	<100 m	Hawaiian	Kilauea
1	gentle	100-1000 m	Haw/Strom	Stromboli
2	explosive	1-5km	Strom/Vulcan	Galeras
3	severe	3-15 km	Vulcanian	Ruiz
4	cataclysmic	10-25 km	Vulc/Plinian	Galunggung
5	paroxysmal	>25 km	Plinian	St Helens
6	colossal	>25 km	Plinian	Krakatoa
7	super colossal	>25 km	Plinian	Tambora
8	mega colossal	>25 km	Plinian	Yellowstone 2Ma

VOLCANOES: A RESULT OF PLATE TECTONIC PROCESSES

- Plate tectonics is a theory that states that the earth's crust is broken into about 12 rigid segments or plates. These plates move relative to one another. Most tectonic processes (earthquakes and volcanoes) occur at or near plate boundaries. There are three types of plate boundaries: divergent, convergent, and transform. Volcanoes occur convergent and divergent boundaries and at hot spots.

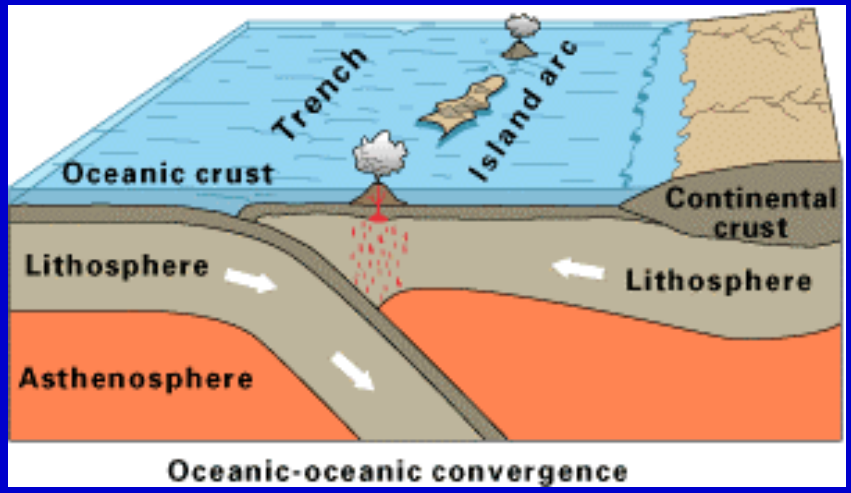
DIVERGENT BOUNDARIES

- Plates move away from each other. Thinning of the earth's crust causes rifting and volcanic activity. Icelandic and submarine eruptions occur at divergent boundaries.

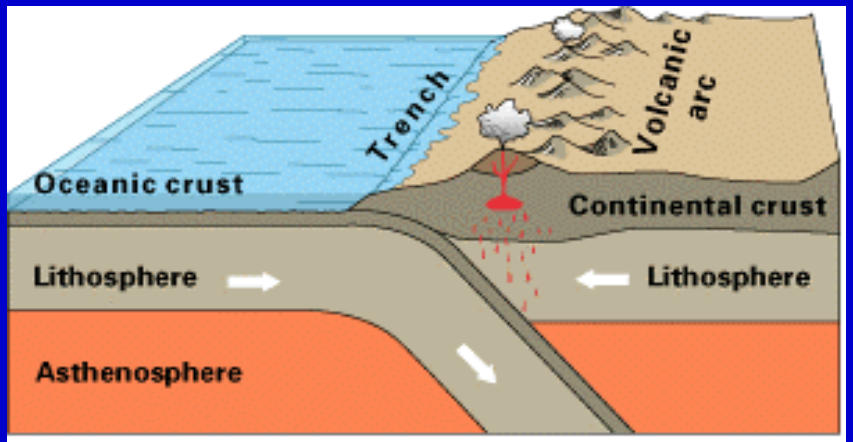


CONVERGENT BOUNDARIES

- Plates move toward each other. Subduction, the sinking of the lithosphere, causes melting of the rock and subsequent volcanic activity. Strombolian, Vulcanian, Plinean, and Pelean eruptions can occur.



Oceanic-oceanic convergence



Oceanic-continental convergence

HOT SPOTS

- Hotspots are long-lasting exceptionally hot regions existing below the plates that provide sources of high-heat energy to sustain volcanism and are not related to plate boundaries. Hawaiian eruptions generally occur at hotspots.